17. (a) Explain the quantum theory of paramagnetism.

(b) Write a note on piezoelectricity.

18. (a) The rotational spectrum of $^{12}C^{16}O$ shows a series of equidistant lines spaced 3.842cm^{-1}. Calculate the rotational constant and the C-O bond length in this molecule.

(b) Explain the principle of Raman effect by classical theory.

19. Explain briefly

(a) Spin-spin coupling

(b) Fourier transformation technique

20. Derive Maxwell-Boltzmann distribution law. Write the significance of the term β.

APRIL/MAY 2024

DCH33/GCH33 — PHYSICAL CHEMISTRY — III

Time : Three hours Maximum : 75 marks

Shanmuga Industries Arts & Science College T.V.Malai

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Give the significance of symmetry factor in an electrode reaction.

2. What are Fuel cells? Give its application.

3. What is antiferromagnetism?

4. What is laser? Write down the applications of laser.

5. Identify which of the following molecule will give both rotational and vibrational spectra

(a) Cl_2

(b) CH_4

(c) CH_3Br

(d) H_2O

6. Distinguish between sequence and progression in electronic spectroscopy.

7. What is Zeeman effect?

8. Calculate the NMR frequency (in MHz) of $_5B^{11}$ in a magnetic field of 1.4092 T Given $g_N = 1.792$ and $\mu_N = 5.05 \times 10^{-27} JT^{-1}$.

9. Why is statistical thermodynamics unsuitable for small systems at low temperature?

10. Using Stirling formula evaluate ln 10!.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Explain the mechanism of hydrogen oxygen evolution reaction,

Or

(b) Write a short note on passivation of metal.

12. (a) What is Hall effect? Explain. Mention few applications of this effect.

Or

(b) Explain the different types of point defects in solids.

13. (a) Explain how P,Q,R branches of absorption bands are obtained in vibrational-rotational spectra of molecules.

Or

(b) Discuss the various types of electronic transitions with example.

14. (a) Explain the theory of NMR spectroscopy.

Or

(b) Discuss the NMR spectra of AMX system.

15. (a) Calculate the translational partition function of a molecule of oxygen gas at 1 atm and 298K moving in a vessel of volume 24.4 dm^3.

Or

(b) Derive the expression for Fermi-dirac statistics.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Derive Butler-Volmer equation for multielectron transfer reactions. Explain its significance and applications.